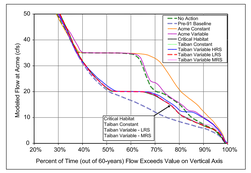
Quantifying Impacts of Changed Reservoir Operations with the Pecos River Decision Support System

A Poster Presentation on the Efforts of the Hydrology/Water Operations Work Group in Support of the Carlsbad Operations NEPA Process

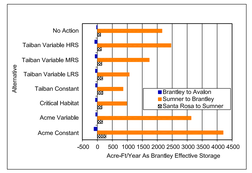
PURPOSE:
Hydrologic modeling of the Pecos River Basin from Santa Rosa to the New Mexico--Texas state line is being conducted as part of the ongoing National Environmental Policy Act (NEPA) process to quantify the benefits of augmenting instream flows for the Pecos bluntnose shiner and the resulting impacts to the irrigation supply of the Carlsbad Irrigation District and compact deliveries to the state line. Modeling policy changes in the NEPA process includes various steps such as bypass modeling, Additional Water Needed (AWN) post processing, Carlsbad Project Water Acquisition (CPWA) modeling, and Additional Water Acquisition (AWA) modeling.

Bypass Modeling

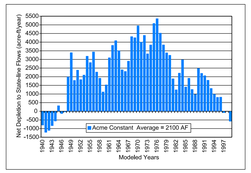
-No Action (current USFWS Biological Opinion) alternative and Pre-1991 baseline plus five alternatives were examined.
-Alternatives vary by target flow stipulations and block release pattern changes.
-Both bypassing water to meet target flows and changes to block release patterns introduce net depletions to Carlsbad Project Supply since water is not being moved as efficiently between Sumner and Brantley Reservoirs.
-Bypass flows are those that Reclamation is simply not exercising its right to divert and store in Sumner Reservoir, with an understanding between CID and Reclamation that Reclamation will eliminate associated depletions caused by bypassing.



Modeled Flow Frequency Results at Acme (Low Discharge/Target Range)



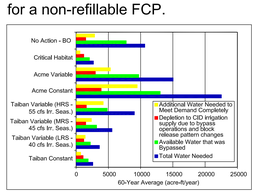
60-Year Average Additional Transmission Losses by Reach (As Brantley Effective Storage)



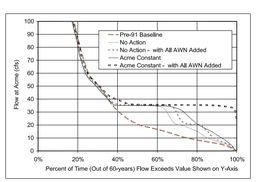
Net Depletions to flows in the Pecos River at the New Mexico-Texas State line as a result of the Acme Constant Alternative

Additional Water Needed (AWN) Post Processing

-Targets cannot always be met with bypass operations since inflow is not always available to bypass through Sumner Dam.
-Post processing of model output enables calculation of Additional Water Needed (AWN) to achieve all the flow targets of a given alternative.
-AWN can be fulfilled through direct acquisition of another water source (Additional Water Acquisition or AWA) or through diverting CID's supply into a fish conservation pool (FCP).
-The annual demand for additional water needed is equal to the required volume for a non-refillable FCP.

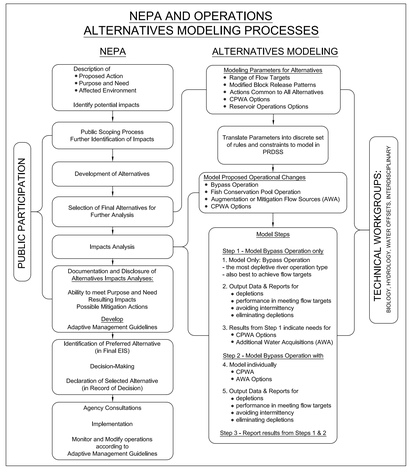


Accounting for Water Needed for the PBNS - Average Additional Water Needed (AWN) Shown in Yellow.



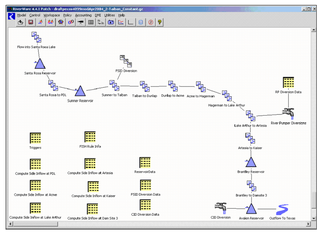
A Comparison of Flow Frequency at the Acme Node for the Acme Constant and No Action Alternatives along with the Pre-1991 Baseline

Aerial View of the Pecos River Near Acme - known habitat for the Pecos bluntnose shiner and a stretch of the Pecos River that is prone to becoming *intermittent.*

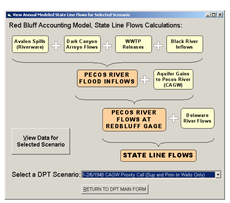


NEPA and Modeling Structure for Proposed Operational Changes (Alternatives) to Quantify Hydrologic Impacts

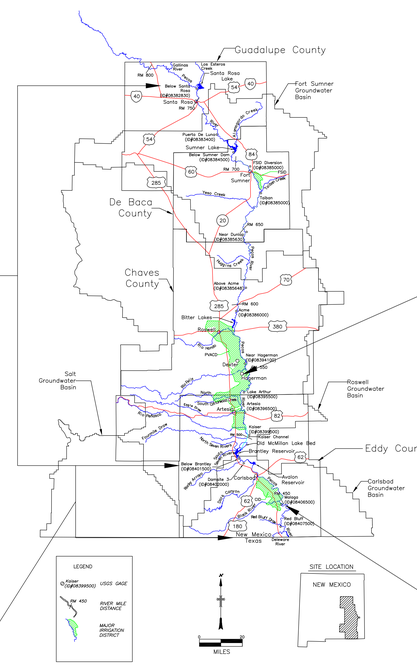
Pecos River Decision Support System Domain:
Simulation of hydrologic processes from Santa Rosa Reservoir to the New Mexico-Texas state line is accomplished through the use of four hydrologic models. These include the Pecos River Water Operations Model, the Roswell Artesian Basin Groundwater Model, the Carlsbad Area Groundwater Model, and the Red Bluff Accounting Model.

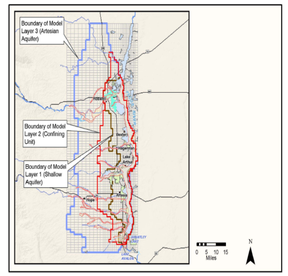


Pecos River Water Operations Model: River Ware model simulates changed river operations from Santa Rosa to Avalon Dam. Models operational policy along with physical processes such as flood wave routing, stream bank storage and returns, diversions, return flows, and channel transmission losses.

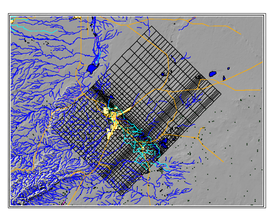


Red Bluff Accounting Model: Provides monthly accounting of deliveries to the state line by aggregating hydrologic output from the Pecos River Water Operations Model and the Carlsbad Area Groundwater Model along with gauged tributary inflows and waste water treatment plant returns.





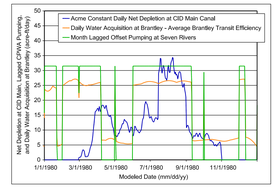
Roswell Artesian Basin Groundwater Model: Simulates well pumping, irrigation return flows, and Pecos River base inflows. Models groundwater movement in shallow and artesian aquifers located in the Roswell area. Loosely coupled to the Pecos River Water Operations model through base inflows from Acme to Artesia.



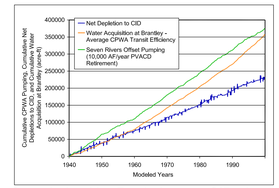
Carlsbad Area Groundwater Model: Simulates impacts of CID irrigation and well pumping to supplement short surface water supplies. Quantifies base inflow gains and irrigation returns from Avalon Dam to the New Mexico-Texas state line.

Carlsbad Project Water Acquisition (CPWA) Modeling

-CPWA options are water sources identified to eliminate the net depletions to CID caused by the reoperation of Sumner Dam.
-Selected CPWA options were modeled with Acme Constant and Taiban Constant (the most and least depletive alternatives) along with the pre-1991 baseline to determine their effectiveness.
-Modeled options included irrigation retirement and leasing, well field pumping, and cropping pattern changes to alternative-low water use crops.



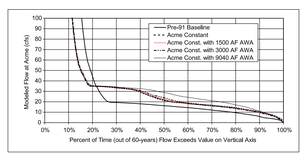
Daily Net Depletions at the CID Main Canal shown with Daily Well Field Pumping and Water Acquisition at Brantley (includes base inflow accretion from groundwater retirement)



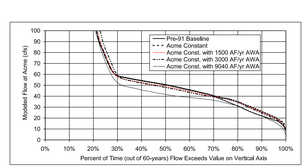
Cumulative Net Depletions to CID shown with Cumulative Well Field Pumping and Cumulative Water Acquisition at Brantley (includes base inflow accretion from groundwater retirement)

Additional Water Acquisition (AWA) Modeling

-AWA water is direct water acquisition for the Pecos bluntnose shiner to augment flows in the upper critical habitat reach.
-AWA water would be relied upon in times when incoming supply to Sumner Dam does not meet alternative demands.
-Modeling AWA helps to determine contributions to instream flows. Note below that modeled FSID forbearance shows improvements to flow frequency in the spring, but shows a detriment in the fall.



Modeled Flow Frequency at Acme in the Spring for AWA water Added to the Acme Constant Alternative--3 annual volumes of FSID forbearance shown. Note improvement to flow frequency in spring.



Modeled Flow Frequency at Acme in the Fall for AWA Water Added to the Acme Constant Alternative--3 annual volumes of FSID forbearance shown. Note worsening of flow frequency due to reduced FSID return flows in this season.